

Physical and Dynamical Linkages between Lightning Jumps and Storm Conceptual Models

Meteorological Applications of Lightning Data

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The presence and rates of total lightning are both correlated to and physically dependent upon storm updraft strength, mixed phase precipitation volume and the size of the charging zone. The updraft modulates the ingredients necessary for electrification within a thunderstorm, while the updraft also plays a critical role in the development of severe and hazardous weather. Therefore utilizing this relationship, the monitoring of lightning rates and jumps provides an additional piece of information on the evolution of a thunderstorm, more often than not, at higher temporal resolution than current operational radar systems. This correlation is the basis for the total lightning jump algorithm that has been developed in recent years.

Currently, the lightning jump algorithm is being tested in two separate but important efforts. Schultz et al. (2014; this conference) is exploring the transition of the algorithm from its research based formulation to a fully objective algorithm that includes storm tracking, Geostationary Lightning Mapper (GLM) Proxy data and the lightning jump algorithm. Chronis et al. (2014; this conference) provides context for the transition to current operational forecasting using lightning mapping array based products. However, what remains is an end-to-end physical and dynamical basis for coupling total lightning flash rates to severe storm manifestation, so the forecaster has a reason beyond simple correlation to utilize the lightning jump algorithm within their severe storm conceptual models.

Therefore, the physical basis for the lightning jump algorithm in relation to severe storm dynamics and microphysics is a key component that must be further explored. Many radar studies have examined flash rates and their relationship to updraft strength, updraft volume, precipitation-sized ice mass, etc.; however, their relationship specifically to lightning jumps is fragmented within the literature. Thus the goal of this study is to use multiple Doppler and polarimetric radar techniques to resolve the physical and dynamical storm characteristics specifically around the time of the lightning jump. This information will help forecasters anticipate lightning jump occurrence, or even be of use to determine future characteristics of a given storm (e.g., development of a mesocyclone, downdraft, or hail signature on radar), providing additional lead time/confidence in the severe storm warning paradigm.